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XLV. *Observations on the Solar Eclipse which happened June 24, 1778. By Mr. William Wales, F. R. S. and Master of the Royal Mathematical School in Christ's Hospital.*

Read July 9,
1778.

THE following observations of the solar eclipse, which happened on the 24th instant, were made at the Royal Mathematical School in Christ's Hospital, where the latitude is $51^{\circ} 30' 55''$ N. and the longitude not quite half a second in time West of the cupola of St. Paul's. I had my time by a most excellent watch made by Mr. LARCUM KENDALL, which goes while it is winding up, and has a provision for counter-acting the effects of heat and cold. It was regulated by double altitudes of the Sun's lower limb, taken from a basin of quicksilver with a HADLEY's quadrant of Mr. RAMSDEN's making; and the quicksilver was shaded from the wind by a roof, formed by two glasses whose planes had been ground perfectly parallel by the same ingenious artist, so that the time may, I think, be depended on within a second, or two seconds at the most.

My telescope, which is of the Gregorian form, was made by the late Mr. SHORT; the focal length of the great speculum being 18 inches, and the aperture $4\frac{1}{8}$ inches.

inches. I used a magnifying power of about 75 times for the beginning and end, and of about 50 or 55 times with the micrometer, in measuring the Sun's diameter, and the distances between the two cusps of the luminaries.

The micrometer, which is an exceeding good one, was made also by Mr. SHORT. The divided glass is not achromatic, but only a single lens, whose focal length is about 28 feet $5\frac{1}{2}$ inches; but as I have not had an opportunity of examining this point myself by adjusting the telescope to parallel rays without the micrometer, and then putting it on, and measuring the distance at which objects are seen distinctly, I have assumed the Sun's apogeal diameter to be $31' 28''$ as given by Mr. SHORT; and on that hypothesis the following reductions of the parts of the micrometer are made. Its error was determined immediately before the beginning of the eclipse, by measuring the angle subtended by a small ball which is on the top of the spire of St. Bride's Church, in Fleet Street, alternately before and after 0, or the beginning of the divisions of the scale: these measurements were as follow:

Off the scale, or before 0.		On the scale, or after 0.		
Inches.	Ver.	Inches.	Ver.	
0,05	4	0,05	11	
0,05	4	0,05	11	
0,05	3½	0,05	12	
0,05	4½	0,05	12½	
0,05	5	0,05	15	
0,05	4,3	0,05	12,3	Mean on the scale.
		0,05	4,3	Mean off the scale.
		0,00	8,0	Difference.

Half the above difference, or four divisions of the vernier, = 4",83, is the error of the micrometer, to be subtracted from the measured distances of the cusps, and also from the diameters of the Sun, taken near the middle of the eclipse, in the same direction with the chords which were measured about the same time: and, this direction being nearly vertical, these measurements will, in some degree, be affected by refraction; but they may readily be corrected if the altitudes of the Sun be computed to the times when they were taken, and from thence the effect of the refractions.

1778	Times by the watch.	Double alt. of ☉'s L. L.	The Sun's diameter				Apparent time.	Watch before ap- parent time.
			before obs.		after obs.			
			On.	Off.	On.	Off.		
♂ June 23	h ' "	° "	'	'	'	'	h ' "	' "
	4 43 7	59 31 $\frac{3}{4}$	19	45 $\frac{2}{3}$	18 $\frac{1}{3}$	46	4 44 28,7	0 58,8
	4 44 6	59 13	18 $\frac{1}{2}$	46	18 $\frac{1}{2}$	46 $\frac{1}{3}$		
	4 44 49	59 0	18 $\frac{1}{2}$	46 $\frac{1}{4}$	18 $\frac{1}{2}$	46 $\frac{1}{3}$		
	4 45 52	58 39 $\frac{3}{4}$	18 $\frac{1}{2}$	46 $\frac{1}{4}$	18 $\frac{1}{2}$	46		
	4 47 1	58 19 $\frac{3}{4}$	18 $\frac{3}{4}$					
4 47 50	58 3 $\frac{3}{4}$							
♂ 24	3 27 35	82 57	23	42	22 $\frac{3}{4}$	42 $\frac{1}{4}$	3 28 10,3	1 29,7
	3 28 40	82 36	23	41	22 $\frac{3}{4}$	42 $\frac{1}{4}$		
	3 29 47	82 16 $\frac{1}{2}$	22 $\frac{1}{2}$	41 $\frac{1}{2}$	22 $\frac{3}{4}$	42 $\frac{1}{4}$		
	3 30 47	82 0	22 $\frac{3}{4}$	41 $\frac{3}{4}$				
	3 31 30	81 47 $\frac{3}{4}$		41 $\frac{3}{4}$				

Observations on the eclipse.

1778	Time by the watch.	Apparent time.	Parts of the Micrometer.		Reduced.	
			Inches.	Ver.		
2 June 24	h m s	h m s				
	3 41 17	3 39 47				Beginning very exact.
	4 2 34	4 0 32	2,15	15	21 51,8	Distance of the cusps.
	4 4 15	4 2 44	2,25	3	22 37,7	Ditto.
	4 5 24	4 3 53	2,30	2	23 6,7	Ditto.
	4 7 56	4 6 25	2,35	18	23 56,2	Ditto.
	4 8 44	4 7 13	2,40	4	24 9,5	Ditto.
	4 9 25	4 7 54	2,40	16	24 24,0	Ditto.
	4 11 54	4 9 34	2,45	19	24 57,8	Ditto.
	4 12 31	4 11 0	2,50	12	25 19,6	Ditto.
			3,10	18	31 29,2	Diameter of the Sun.
			3,10	17	31 28,0	Ditto.
			3,10	18	31 29,2	Ditto.
	4 21 52	4 20 21	2,65	17	26 56,2	Distance of the cusps.
	4 21 51	4 22 20	2,70	11½	27 19,8	Ditto.
	4 27 24	4 25 31	2,75	2	27 38,5	Ditto.
	4 29 36	4 28 5	2,75	4	27 40,9	Ditto.
	4 31 31	4 29 59½	2,75	8	27 45,7	Ditto.
	4 34 44	4 32 32½	2,75	16	27 55,4	Ditto.
	4 35 46	4 34 14½	2,75	18	27 57,8	Ditto.
	4 36 56	4 35 24½	2,75	15	27 54,2	Ditto.
	4 37 54	4 36 22½	2,75	15½	27 54,8	Ditto.
	4 38 38	4 37 6½	2,75	16½	27 56,0	Ditto.
	4 39 18	4 37 46½	2,75	16	27 55,4	Ditto.
	4 40 41	4 39 9½	2,75	14	27 53,0	Ditto.
	4 41 39	4 40 7½	2,75	13	27 51,8	Ditto.
	4 42 36	4 41 4½	2,75	4	27 40,9	Ditto.
	4 43 33	4 42 1½	2,70	21	27 31,2	Ditto.
	4 40 46	4 45 14½	2,70	14	27 22,8	Ditto.
			3,10	16	31 26,8	Diameter of the Sun.
			3,10	16	31 26,8	Ditto.
			3,10	16½	31 27,4	Ditto.
			3,10	15½	31 26,2	Ditto.
	4 52 40	4 51 8	2,60	11	26 18,8	Distance of the cusps.
	4 53 34	4 52 2	2,60	8	26 15,1	Ditto.
	4 54 20	4 52 48	2,60	3	26 9,1	Ditto.
	4 55 10	4 53 38	2,55	22	26 0,6	Ditto.
	5 26 34	5 25 1½				The end.

Time by the watch.	Double alt. of \odot 's L. L.	The Sun's diameter				Apparent time.	Watch before ap- parent time.
		before obf.		after obf.			
		On.	Off.	On.	Off.		
h / "	o / "	/	/	/	/	h / "	/ "
5 34 6	43 59 $\frac{3}{4}$	22	42	22	41 $\frac{1}{2}$	} 5 34 31,2	1 32,8
5 35 4	43 43	22	42	21 $\frac{3}{4}$	41 $\frac{1}{2}$		
5 35 40	43 29 $\frac{1}{4}$	22 $\frac{1}{4}$	41 $\frac{1}{2}$	22	41 $\frac{1}{2}$		
5 36 37	43 12						
5 37 5	43 2 $\frac{1}{2}$						
5 37 53	42 51 $\frac{3}{4}$						

